EMPOWERING DISABLED COMMUNICATION: DESIGNING AND IMPLEMENTING GESTURE RECOGNITION SYSTEM

[1]K. Manjusha, [2]K. Varshitha, [3]G. Sai Varsha, [4]P. Bharath

[1] Assistant Professor, Department of Electronics and Communication Engineering, St. Peter's Engineering College,Hyderabad, Telangana, India

[2,3,4] UG Student, Department of Electronics and Communication Engineering, St. Peter's Engineering College, Hyderabad, Telangana, India

ABSTRACT

In general, individuals who are deaf, mute, or blind rely on sign language as their primary mode of communication. To bridge the communication gap between the two groups employing gloves, gesture recognition, or sign language-detecting technology is also required. When the data of the Force sensor, at the transmitter side, input signals from flex sensors, ultrasonic sensor, and water level/soil-moisture sensor are provided to the microcontroller input pin. These sensors detect various gestures and environmental conditions. The microcontroller processes the received signals and generates corresponding voice outputs for each gesture. At the receiver side, the voice outputs are converted into text format and displayed on an LCD screen. This allows the recognized gestures to be easily understood and observed through the flex sensors. Also, we get the message through SMS in mobile phones and alarms through buzzers as a result of Ultrasonic and water level/soil-moisture sensors. The major goals of smart gloves are to make it simpler for individuals who are physically impaired (deaf, dumb, and blind) to collaborate and share fundamental ideas. Our project's primary objective is to create an affordable system that empowers individuals with disabilities to thrive and excel in their chosen fields.

Keywords: Flex sensors, Ultrasonic sensor, soil/Moisture sensor, LCD Board.

INTRODUCTION

Traditional and deaf-dumb people may naturally communicate by using sign language. Hand gesture recognition is often a big deal in linguistic communication. Another definition of a gesture is a movement, sometimes of the hand, that conveys an idea. Linguistic communication may be a defined mode of expression in which each letter or word is assigned a certain gesture. Traditional people typically have a hard time reading the signs correctly and understanding what they need to say. Let's imagine for a moment that a traditional person wants to converse with a hearing-impaired person, but that person is far away, making it difficult for the traditional person to speak plainly to the person.

Speech is the fundamental tool for interacting with and communicating with other people. Therefore, a person who has hearing loss or a hearing impairment does not communicate well with others and society as a whole, which naturally leads to isolation. This is especially true for people with hearing impairments who are born deaf because they cannot express themselves or communicate with others because they cannot speak, contrary to what some people believe about those who are deaf or dumb.

One of the major issues facing our society is the difficulty that those with impairments have in developing rapidly evolving technologies. For those with disabilities, having access to communication tools has become crucial. People who are deaf or dumb can communicate by signing, but they have trouble doing so with those who don't know sign language. A natural and expressive form of communication for both normal and dumb individuals is sign language.

An individual can use sign identification to pin out at a computer or portable screen and use linguistic communication to choose and use completely different implementations inside the device. The normal person will be able to understand the language used by deaf and mute people using this approach, and it will be given new meaning, allowing for better communication between the two groups of people.

The Internet of Things (IoT) is the interconnection of physical devices, such as cars, houses, and other objects, with a network of hardware, sensors, and actuators that enable each object to gather and exchange data. The fundamental IoT building blocks are sensors and actuators. While actuators depend on the data detected, sensors primarily perceive the physical marvel that is occurring around them. Actuators then carry out some action on the physical requirements.

LITERATURE SURVEY

In 2010, Ali, S. Munawar, and B. Nadeem developed an Electronic Speaking Glove for Speechless Patients. The primary objective of this project was to enable effortless communication for individuals who are unable to speak using electronic speaking gloves. The system employed an AVR (Advance Virtual RISC) microcontroller to recognize gestures, and it would generate audible messages to convey the user's intent to others. The speaking glove proved particularly helpful in emergency situations, allowing speechless individuals to effectively communicate with healthcare professionals.N. P. Bhatti, A. Baqai, B. S. Chowdhury, and M. A. Umar, developed an Electronic Hand Glove for Speech Impaired and Paralyzed Patients. The main objective of this project is to reduce the communication gap between speechless and paralyzed people and normal people using a smart glove and generate voice output and text through an Android application on an Android mobile phone. It was published in 2009.

In their publication in 2018, Aruljothy. S, Arunkumar. S, Ajitraj. G, YayadDamodran.D, Jeevanantham. J, and Dr.M. Subba proposed a project titled "Hand Gesture Recognition Using Image Processing for Visually Impaired and Dumb People." The aim of this project was to address the communication gap between individuals with disabilities and those without disabilities by employing smart gloves. The project utilized image processing techniques to recognize hand gestures and facilitate communication for visually impaired and mute individuals.

Shital P. Dawane and Prof. Hajiali G. Sayyed proposed a review on Hand Gesture Recognition for Deaf and Dumb People Using GSM Module. This project aims to develop a gesture recognition system for deaf and dumb people for easy communication. It was published in 2016.

In 2007, Nikolaos Bourbakis, Nana Sposito, and Kabraki conducted a study on the implementation of multi-modal interfaces to facilitate interactive communication between individuals with hearing and visual impairments. The main objective of their research was to enhance communication and promote greater participation among individuals who are blind and deaf. The study focused on addressing the challenges, issues, and obstacles related to multi-modal interfaces to create effective solutions that improve communication accessibility for these individuals.

In 2015, Allavi Verma, Shimi S, and Icha Riyadarshani undertook the implementation of a communication interpreter for individuals who are deaf and mute. The main objective of their project was to develop an affordable system that could give voice to those who currently lack it, using smart gloves as the communication medium. The proposed system utilized a flex sensor and microcontroller to convert sign language gestures into both text and audio outputs. By employing smart gloves, the project aimed to eliminate communication barriers between these two distinct populations, enabling effective communication and understanding.

In 2012, Netchanok Tanyawiwat and Surapa Hiemjarus worked on the design and implementation of an assistive communication glove that utilized combined sensory channels. The study focused on developing a wireless sensor glove specifically designed for identifying finger spelling gestures in American Sign Language (ASL). Signals from six speech-impaired patients and one person without speech impairments were collected to conduct trials for ASL finger spelling gesture recognition. The novel design of the wireless sensor glove aimed to enhance communication capabilities for individuals who rely on finger spelling in ASL, ultimately assisting them in expressing themselves more effectively.

PROPOSED SYSTEM

This project centers around a force sensor that is placed on the finger and responds to applied force by altering its resistance. The algorithm proposed for this project involves employing four force sensors per finger, with each sensor's voltage range linked to a specific message. These messages are then presented on an LCD display and voiced out loud through the speaker.

Load cells, also known as force sensors, are devices that convert applied force into measurable electrical signals. In the context of our system, these sensors transform the known applied load into voltage readings. The STM32 microcontroller processes these voltage inputs and utilizes them to display corresponding messages on the LCD board. Additionally, the microcontroller triggers an audible announcement through the speaker. In our implementation, the messages "Hungry" and "Need Water" have been chosen for this purpose.

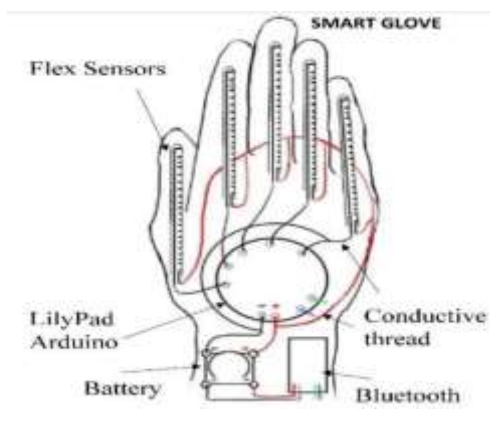

Fig: Smart Glove

Fig: Glove translates sign language into text and voice

Already certain needs are recorded through voice in the APR9600 voice module. So, when the input is given for a certain need then the voice gets out through the speaker.

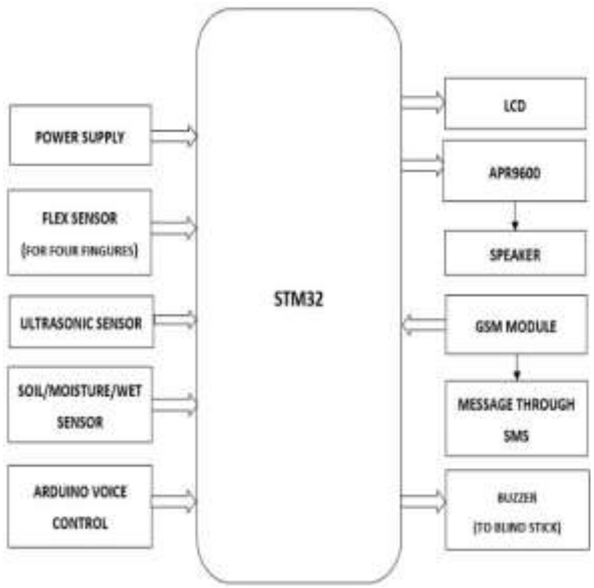

Fig: Block Diagram

The STM32 microcontroller serves as the central processing unit of our system, housing the program instructions necessary for its operation. Upon initiating the finger command, the controller examines the predefined condition, subsequently resulting in the intended outcome. This includes displaying the corresponding output on the LCD board and playing a voice recording through the speaker. The APR9600 VOICE IC module is responsible for storing and retaining the recorded sound, even when the power supply is disconnected. The audio playback exhibits remarkable clarity with minimal background noise, providing an optimal user experience.

This type of output serves as a means of communication that enables individuals with hearing and speech impairments to interact effectively with those who do not have such limitations. In the case of blind people, the ultrasonic sensor detects the obstacle or any vehicles while walking on the road and helps them from danger. If the disabled are in danger, the notification is sent through SMS in a mobile application in the sign of alert.

The ultrasonic sensor detects the obstacle at the transmitter side and gives the alert through a message on the LCD board at the receiver side. water level/soil-moisture sensor sense the water on the floor and gives an alert through message and helps the disabled in cases during Rainy days while they walk on the road when they walk near the manholes.

When voice input is given through the Arduino voice control application the buzzer gives an alert, this helps blind people to find their blind stick.

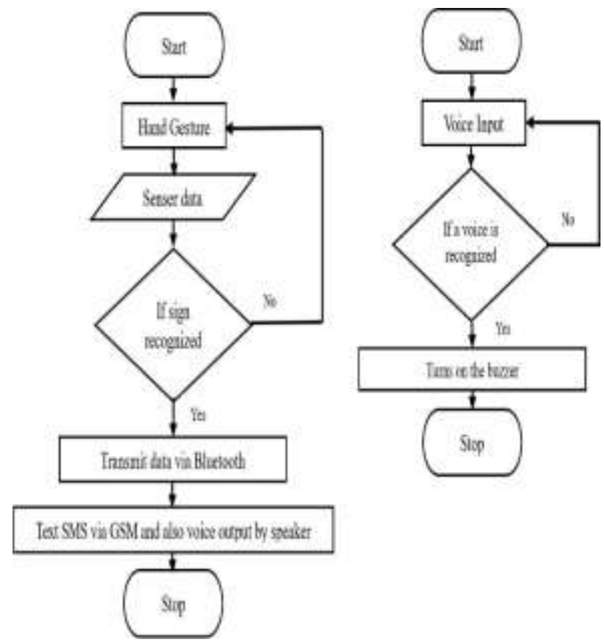

Fig: Flow Chart

The project starts with the recognition of hand gestures Once a sign is recognized; the system proceeds to provide the corresponding output in the form of voice through the speaker. Additionally, the system utilizes a GSM module to transmit the same information through SMS. This dual mode of output allows for effective communication and dissemination of information to the intended recipient. The same goes with blind people where the voice input is recognized and gets the buzzer turns on.

RESULTS

The data for all the input and output functions are stored in the STM32 microcontroller. At the transmitter side, the flex sensor sends the input signals when a gesture is made, the flex sensor resistance changes as it is bent when an action is done.

The change in resistance transmits the input signals to the microcontroller and this gives the voice output through the speaker, here voice is already stored in the APR9600 Voice module, sends messages through SMS, and displays on the LCD. When an ultrasonic sensor detects an object(vehicle) over a distance it displays that "obstacle is detected", and also sends a message through SMS using GSM Module at the receiver side. The water level/soil-moisture sensor at the input side detects the water on the floor and prevents danger in advance. When a voice input is given using 'The Arduino voice controller application', the buzzer gives the alert indicating the object/home appliance they need to find.

Fig: Hardware implementation of the gesture recognition system

The "Gesture Recognition System" plays a crucial role in bridging the communication gap between individuals with disabilities, such as the deaf, mute, and blind, and those without disabilities. It serves to minimize barriers to communication and also serves as an alert system to keep individuals with disabilities informed about potential dangers.

CONCLUSION

The multifunctional mitten offers a significant advantage by effectively bridging the communication gap between individuals with various impairments, including hearing, speech, and visual disabilities, as well as those without any disabilities. The mitten performs two functions. Both communication and appliance control is possible with it. Real-time translation is offered, and it is simple to use. The number of individuals who are impaired, such as blind, deaf, and dumb, is growing daily, and it is discovered that the devices used to help them are highly expensive and not particularly effective for everybody. The majority of them live in a single room their whole lives since they cannot pay the cost. The key benefit of this product is the device's portability, which allows users to go anywhere and connect with people with ease. It is also incredibly affordable and user-friendly. As a result, technology enables people to live independently in society without the aid of a third party. People who are physically challenged or deaf-dumb can benefit greatly from this technology. In comparison to other suggested papers, the Smart Mitten for Disabled People will provide users with a solution that is more dependable, effective, simple to use, and lightweight. This is what will give disabled people's life purpose.

FUTURE SCOPE

The current work includes basic signs language of needs which can be further extended to ASL language. The system may also be upgraded to provide wireless data transmission capabilities. The Bee Module may be used to do this. In this essay, the identification of ASL alphabets in single and double hands is demonstrated. To display the output of the glove creation on the computer screen, the project presently makes use of the serial monitor of the STM32 model. The text-to-sound converter IC may be used to pronounce words and alphabets. The system can identify indications faster now. Additionally, a real-time recognition ratio of around 99% is easily attainable. The system can incorporate audio talkback through an Android app, enabling simultaneous and immediate transmission of the data or signals generated by the user.

REFERENCES

[1] Ali, S. Munawar, B. Nadeem, "Electronic Speaking Glove for Speechless Patients", August 2010, Bachelor of Electronic Engineering FYP Report, FEST, HIIT, Hamdard University, Karachi, Pakistan.

[2] N. P. Bhatti, A. Baqai, B. S. Chowdhury, M. A. Umar, "Electronic Hand Glove for Speech Impaired and Paralyzed Patients", EIR Magazine, May 2009, pp. 59-63, Karachi, Pakistan.

[3] Aruljothy.S,Arunkumar.S, Ajitraj.G, YayadDamodran.D. Jeevanantham.J,Dr.M.Subba " HAND GESTURE RECOGNITION USING IMAGE PROCESSING FOR

VISUALLY IMPAIRED AND DUMB PERSON" – International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), 2018.

[4] Shital P. Dawane, Prof. Hajiali G. Sayyed "A REVIEW ON HAND GESTURE RECOGNITION FOR DEAF AND DUMB PEOPLE USING GSM MODULE" - International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering,2016.

[5] Nikolaos Bourbakis, nana sposito, Kabraki "MULTI-MODAL INTERFACES FOR INTERACTION COMMUNICATION BETWEEN HEARING AND VISUALLY IMPAIRED INDIVIDUALS"- IEEE,2007.

[6] allavi Verma, Shimi S., icha Riyadarshani "DESIGN OF COMMUNICATION INTERPRETER FOR DEAF AND DUMB PERSON "- International Journal of Science and Research (IJSR),2015.

[7] Netchanok Tanyawiwat and Surapa Hiemjarus "DESIGN OF AN ASSISTIVE COMMUNICATION GLOVE USING COMBINE SENSORY CHANNELS" – IEEE,2012.

[8] avid J. Sturman "A SURVEY OF GLOVE- B S U", IEEE-2004